1,067,043

PATENT SPECIFICATION

NO DRAWINGS

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1,067,043

Date of Application and filing Complete Specification: April 6, 1964.

No. 14035/64.

Complete Specification Published: April 26, 1967.

Index at acceptance:—B5 LB2; C3 R(1C2, 1C5, 1C8, 1C12, 1C16, 2C2, 2C5, 2C8, 2C12, 2C16, 27K2C2, 27K2C5, 27K2C8, 27K2C16, 29C2, 29C5, 29C8, 29C12, 29C16)

Int. Cl.:—B 29 j//C 09 j

COMPLETE SPECIFICATION

Improvements in or relating to the Forming of Composite Wood Products

We, MO OCH DOMSJO AB, a Swedish body corporate of Omskoldsvik, Sweden, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a method for forming composite wood products. In particular, the invention relates to the provision of adhesives suitable for gluing laminated wood products such as veneer, plywood and lamellated wood, and particle board.

Composite wood structures of the above type are usually glued by applying a layer of a viscous solution or dispersion of a thermosetting adhesive to the individual wood components, which are then assembled and exposed to heat and pressure. The best thermosetting adhesives for this purpose are based on thermosetting synthetic resins such as urea-formaldehyde resins, phenol-formaldehyde resins, resorcinol-formaldehyde resins, melamine-formaldehyde resins and furfurol-formaldehyde resins, which are applied in a partially condensed state and subsequently hardened by means of a hardener and the application of heat and pressure. If the adhesive is solid in its partially condensed state, a solvent, such as water, is added in order to obtain the desired consistency for application to the wood. The polycondensation of the resins must, therefore, be interrupted whilst the resin is still soluble in water in colloidal form.

Glue is usually delivered to the wood working industry as an aqueous solution; for example urea-formaldehyde resins are delivered as 57—70% aqueous solution (all concentrations and proportions are by weight); however it is sometimes spray-dried and delivered as a water-soluble powder.

When the glue is used in the wood working industry a hardener is added to the resin to increase the rate of polycondensation. In some cases an extender is also added to the resin in order to reduce costs or increase the viscosity. Such extenders usually consist of water-soluble polysaccharides.

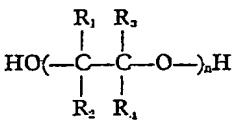
Before being glued the wood material normally is dried to a moisture content of 3—10 percent and liquid glue is then applied; in the production of plywood and lamellated wood this is usually carried out on a machine. In the production of particle board the glue is sprayed on to the surface of the dried wood particles and homogeneously distributed over the particles in a mixing machine. After the glue has been applied the material is pressed at pressures of 3 to 20 kg./cm.^{2} and temperatures of 20 to 140°C. Hot-setting glues are usually pressed at temperatures within the range 60—140°C.

In many cases, however, weak glue lines are obtained, because the transfer of glue to the wood is unsatisfactory; in particular the wetting of the wood surface by the glue is considerably impaired at those parts of the surface which contain high proportions of natural resin. Another disadvantage with known thermosetting adhesives is the tendency of the glued wood material to shrink and swell when exposed to varying humidity conditions.

An object of the present invention is to provide a method for the glueing of laminated wood materials such as veneer, plywood, lamellated wood and particle board, which is not subject to the above disadvantages.

The invention comprises a process for the

production of composite wood products, which comprises applying to the individual wood components an aqueous solution or dispersion of an adhesive composition and then assembling the components and subjecting the assembly to the action of heat and pressure, wherein the adhesive composition comprises a urea-formaldehyde resin glue, phenol-formaldehyde resin glue, resorcinol-formaldehyde resin glue, melamine-formaldehyde resin glue, furfurol-formaldehyde resin glue or a mixture of two or more of these, a hardener for said adhesive, and 0.5 to 60 percent by weight (calculated on the amount of thermosetting adhesive) of a glue transfer improving agent consisting of one or more polyalkylene glycols of molecular weight 106 to 1000 and of the general formula:



wherein the several R radicals are hydrogen or alkyl groups of 1—4 carbon atoms and n is at least 2 and corresponds to the molecular weight of the polyalkylene glycol.

Mixtures of glycols may comprise glycols of different molecular weights; one preferred mixture comprises two polyethylene glycols with molecular weights of 400 and 1000 respectively. Such mixtures may be useful owing to the greater surface activity of the polyglycols of molecular weight lower than 600.

The best results are usually obtained using 2 to 25 percent of the glue transfer improving agent, (calculated on the amount of thermosetting adhesive).

In making the adhesive compositions the glue transfer improving agent can be mixed directly into the liquid or solid mixture of precondensed resin and hardener or it may be added separately to the hardener. The addition can be made before or after a solvent or extender has been added in order to obtain a suitable consistency of the glue composition. Preferred mixing schemes are given below for both liquid and solid resins.

Liquid synthetic resin

1. Liquid resin is charged into the mixer.
2. Extender is added, if desired.
3. Hardener is added.
4. Glue transfer improving agent is added.
5. Water is added to obtain desired viscosity.

Solid synthetic resin

1. Half the desired amount of water is charged into the mixer.
2. Synthetic resin is added.
3. Further water is added.
4. Extender is added, if desired.
5. Hardener is added.
6. Glue transfer improving agent is added.
7. Further water is added to obtain desired viscosity.

In some cases it may be advantageous to incorporate into the adhesive composition other agents such as insecticides, fungicides and flame-proofing agents with the glue transfer improving agents. Extenders and fillers are incorporated in the liquid adhesive composition for several reasons. In general fillers are inert and extenders usually exert some small adhesive effect. Suitable extenders are water-soluble polysaccharides, e.g. cellulose derivatives, starch, wheat-, rye- or pea-flour, dextrin and sugar. Examples of suitable water-soluble cellulose derivatives are cellulose ethers such as ethyl hydroxy-ethyl cellulose, methyl hydroxyethyl cellulose, methyl cellulose, hydroxyethyl cellulose and carboxymethyl cellulose, and cellulose esters such as cellulose sulphate. The water-soluble polysaccharides are usually added in amount 5 to 35 percent of the total dry weight of the composition.

The presence of the glue transfer agent in the adhesive composition greatly facilitates complete action of the adhesive forces between the adhesive and the wood surface, as a result of the even and complete wetting of the wood fibres by the adhesive, so that a stronger glue joint is obtained. It also considerably reduces the tendency of the wood material to shrink and swell when exposed to varying humidity conditions. Furthermore, the glue transfer improving agent replaces some of the water which would otherwise be needed in the composition, thereby reducing the amount of water to be vapourised during setting, and some agents also increase the viscosity of the composition, so making possible a reduction of the amount of synthetic resin.

The invention is illustrated in the following Examples, "parts" and percentages are by weight.

EXAMPLE I

Urea resin glue for glueing veneer in the production of plywood was prepared by mixing the following components in the order given:

1. 85 parts of urea-formaldehyde resin (67% solid 33% water)
2. 40 parts of carboxymethylcellulose of viscosity 4000 cp. in 2% aqueous solution at 20°C
3. 20 parts of wheat flour
4. 15 parts of ammonium chloride (50% aqueous solution), as hardener
5. 20 parts of polyethylene glycol of molecular weight 400.

This glue was used in the production of a 5 ply 10 mm. birch plywood (2×1.6 mm.+ 3×2.6 mm.), the glue being machine applied. It was found that the glue had better wetting properties for the veneer surface than a simi-

lar glue composition which did not contain polyethylene glycol. In a knife test the glue gave an adhesive factor of 7.3, whereas the glue which did not contain polyglycol gave a factor of 5.3.

EXAMPLE II

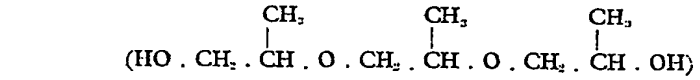
Urea resin glue for glueing veneer in the production of plywood was prepared by mixing the following components in the order given:

1. 100 parts urea-formaldehyde resin
2. 5 parts rye-flour
3. 10 parts ammonium chloride
4. 10 parts polyethylene glycol of molecular weight 1000
5. 10 parts water.

The glue was used in the production of 4 mm. pine plywood of 3 plies (3×1.6 mm.) and it was found that the glue had better wetting properties for the veneer surface than a similar glue composition which did not contain polyethylene glycol. The plywood glued with the glue of the invention also had better dimensional stability than the control and remained plane even when stored at high and low relative humidities. The glue joint obtained was tested and found waterproof.

EXAMPLE III

A glue similar to that of Example I was employed except that the polyethylene glycol was replaced by tripropylene glycol



The same difference in properties between the plywood so obtained and a control plywood as in Example I were observed.

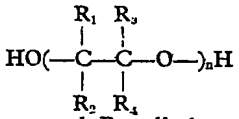
EXAMPLE IV

A particle board was prepared from dried wood chips which were first surface treated with a paraffin wax emulsion and then impregnated with a glue containing 55% of urea-formaldehyde resin, 10% of polyethylene glycol 400 and 9% of ammonium chloride.

The particle board produced had better dimensional stability and showed less swelling and shrinking when exposed alternately to damp and dry air than a particle board glued with a straight 55% urea-formaldehyde resin.

WHAT WE CLAIM IS:—

1. Process for the production of composite wood products, which comprises applying to the individual wood components an aqueous solution or dispersion of an adhesive composition and then assembling the components and subjecting the assembly to the action of heat and pressure, wherein the adhesive composition comprises a urea-formaldehyde resin glue, phenol-formaldehyde resin glue, resorcinol-formaldehyde resin glue, melamine-formaldehyde resin glue, furfurol-formaldehyde resin glue or a mixture of two or more of these, a hardener for said adhesive, and 0.5 to 60 percent by weight (calculated on the amount of thermosetting adhesive) of a glue transfer improving agent consisting of one or more polyalkylene glycols of molecular weight 106 to 1000 and of the general formula:



wherein the several R radicals are hydrogen or alkyl groups of 1—4 carbon atoms and n is at least 2 and corresponds to the molecular weight of the polyalkylene glycol.

2. Process according to claim 1 in which the amount of glue transfer improving agent in the adhesive composition is 2 to 25 percent.

3. Process according to claim 1 or 2 in which the glue transfer improving agent is a mixture of two polyalkylene glycols of different molecular weights.

4. Process according to any of the preceding claims wherein the adhesive composition also contains 5 to 35 percent by weight of a water-soluble polysaccharide (calculated on the total dry weight of the composition).

5. Process for the production of composite wood products according to claim 1 substantially as hereinbefore described.

6. Composite wood products obtained by a process claimed in any one of claims 1—5.

7. Laminated wood products and particle board obtained by a process claimed in any one of claims 1—5.

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14 South Square, Gray's Inn, London, W.C.1.

Leamington Spa: Printed for Her Majesty's Stationery Office by the Courier Press.—1967.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.